http://go/dbm-poirot

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Status: Final
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Over half of DBM bidding goes through third-party exchanges, many of which do not run clean second price auctions. Fixed CPM bidders have the same bid in these unclean exchanges as they do in clean exchanges, which is suboptimal. The goal of Poirot is to discover the exchanges that deviate from second pricing and bid appropriately on these to improve advertiser performance on these exchanges.

Comment [1]: do you know which exchanges are not 2nd priced? and how many of those are first priced?

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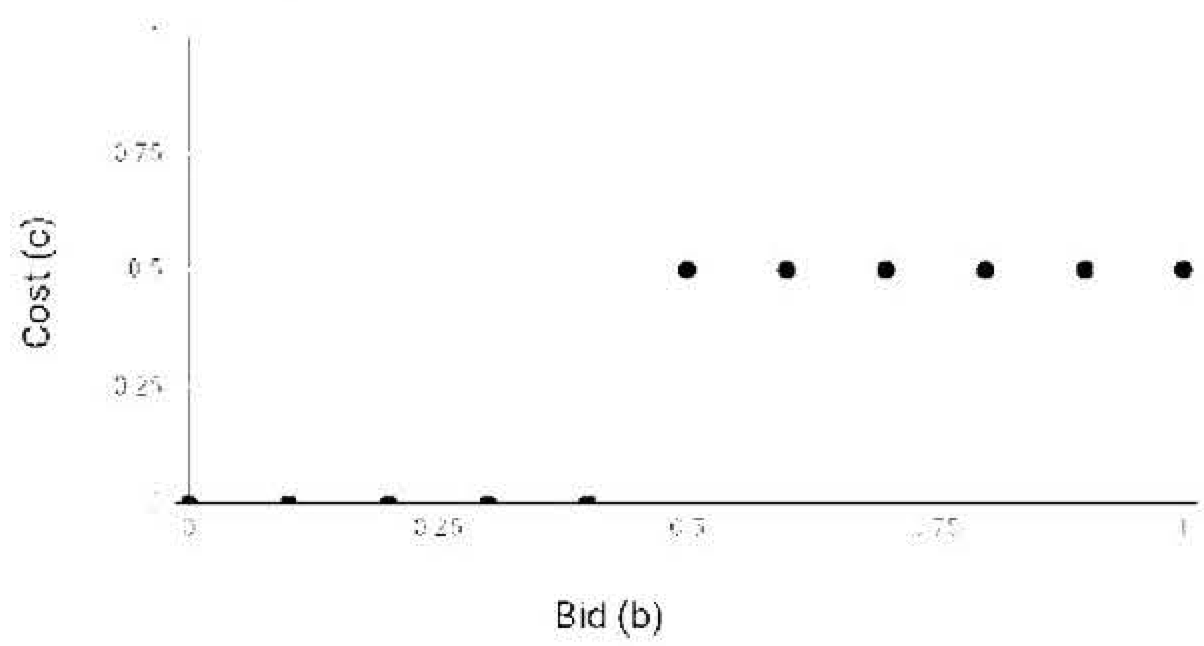
1:23-cv-00108

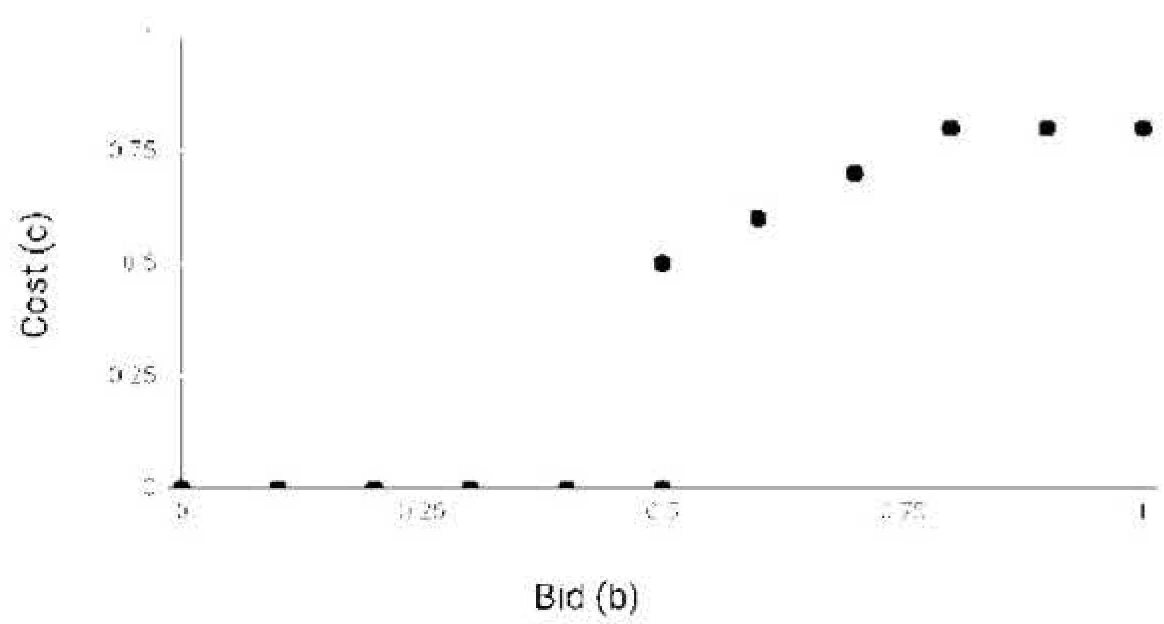
In a second price auction, the price for the winning ad is determined by the bid of the second-highest bidder (or by a reserve price). A bid above this clearing price wins and pays the clearing price; the price does not depend on the advertiser's own bid.

In a true second price auction, bidding low will sometimes cause us to lose an impression, but will never result in us winning the same impression cheaper. In a non-second-price auction, it is sometimes possible to win the same impression cheaper. See the following illustrations of a second price and a non-second price auction.

Clean second price auction



Non second price auction



The non-second-price auction may or may not be fully first-price, but it has at least some range of bids where the cost is an increasing function of bid, whereas the second price auction does not.

The above graphs are theoretical examples; however we have measured non-second pricing on

third party exchanges in AWBID here.

Given a second price auction, the optimal strategy for an advertiser who has a value **v** for an impression is to bid **b=v**. In a non second-price auction, the price the advertiser pays depends on its bid, which means that the optimal strategy may be to bid **b'<v**. In particular, the optimal strategy would be to bid the lowest amount at which the advertiser still wins the impression (assuming that this amount is less than the advertiser's value; otherwise the advertiser would prefer not to win).

Key assumption: a fixed CPM bidder will use a bid **b** equal to the value **v** that it places on the impression.

We then adjust the advertiser's bid in order to maximize the **surplus**

$$\sum_{i} v - c_i$$

where the sum is over all won impressions and $c_i$is the cost of each impression.

The assumption is motivated by the fact that the surplus-maximizing bid in a second price auction is **b=v**. Another way of stating the assumption is that we interpret the advertiser's bid as a bid into a second price auction and adjust the bid in non-second-price auctions to optimize for the same quantity that a second-price auction does. As a consequence, this bid adjustment is a no-op in a pure second price auction.

Note that this project is only applied to Fixed CPM bidders, which is why we can talk about "the" bid of an advertiser, as opposed to multiple different bids across different auctions. (More precisely, it will apply to open auction fixed CPM bidders, not to private auctions or deals).

In order to learn the optimal bids, we run exploration experiments where we lower the bid using fixed multipliers to determine a landscape of volume and costs and a function of bid.

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Metrics

The stats here are based on a 5% experiment over 5 days.

The impacts seen in the experiment are summarized in the table below. The budget effects have not been factored in here.

Metric	Control	Experiment	Change
impressions	944218972	897971771	-4.90%

revenue	$2,577,617	$2,322,807	-9.89%
payout	$2,049,614	$1,846,847	-9.89%
value	$11,002,104	$10,904,417	-0.89%
surplus	$8,952,491	$9,057,569	1.17%
revenue/value	0.234	0.213	-9.08%

The following table shows the impact limited to the non-second price auction exchanges

Metric	***control***	***experiment***	***change***
impressions	307133612	256337080	-16.54%
revenue	$1,073,304	$806,624	-24.85%
payout	$834,979	$623,239	-25.36%
value	$1,370,873	$1,242,579	-9.36%
surplus	$535,894	$619,339	15.57%
revenue/value	0.783	0.649	-17.09%

Assuming that we continue to spend all budgets, the following table shows the impact once the budget server adapts.

Metric	**Control**	**Experiment**	**Change**

Adsense DBM revenue	$240,883	$262,419	8.94%
Adx DBM revenue	$1,045,066	$1,145,102	9.57%
Clean 3p DBM revenue	$226,133	$246,037	8.80%
Unclean 3p DBM revenue	$1,073,653	$880,072	-18.03%
Total DBM revenue	$2,585,735	$2,533,631	-2%

Inventory quality metrics (shown below) are mostly neutral.

Metric	sub-metric	Control	Experiment	Change
Active view rate				Neutral
Video completion rate		33.23%	33.4%	0.5%
Brand metrics	**E**	52.73%	53.04%	0.58%
	PG	30.85%	30.29%	-1.84%
	T	9.92%	9.95%	0.33%
	MA	3.69%	3.74%	1.33%

Advertiser performance metrics are positive.

Metric	Value
CPD	+5%
ClicksPD	+5%
Cost per AV	+7%
CPD (unclean 3p exchanges)	+14%
ClicksPD (unclean 3p exchanges)	+12%

ClicksPD and ConversionsPD are both better (extremely better in case of ClicksPD) than what is achieved using a uniform bid lowering, when compared to the corresponding volume drops.

Launch

We propose doing a flip-the-switch launch as opposed to a gradual rollout.

- Exchanges will see an impact from this launch. We would prefer to have the launch go out at once rather than have the exchanges see a sequence of payout drops.
- As mentioned above in the budget section, we expect the budget system to react quickly. Furthermore, in the absence of BEI, we plan to look at stats before and after the launch. This will be easier if we have a clean launch.

Frontend section description is here. Backend section description is here.

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We will also use an existing tool to monitor the prod experiment file for staleness.